Core OS

State of the Union

Simon Patience

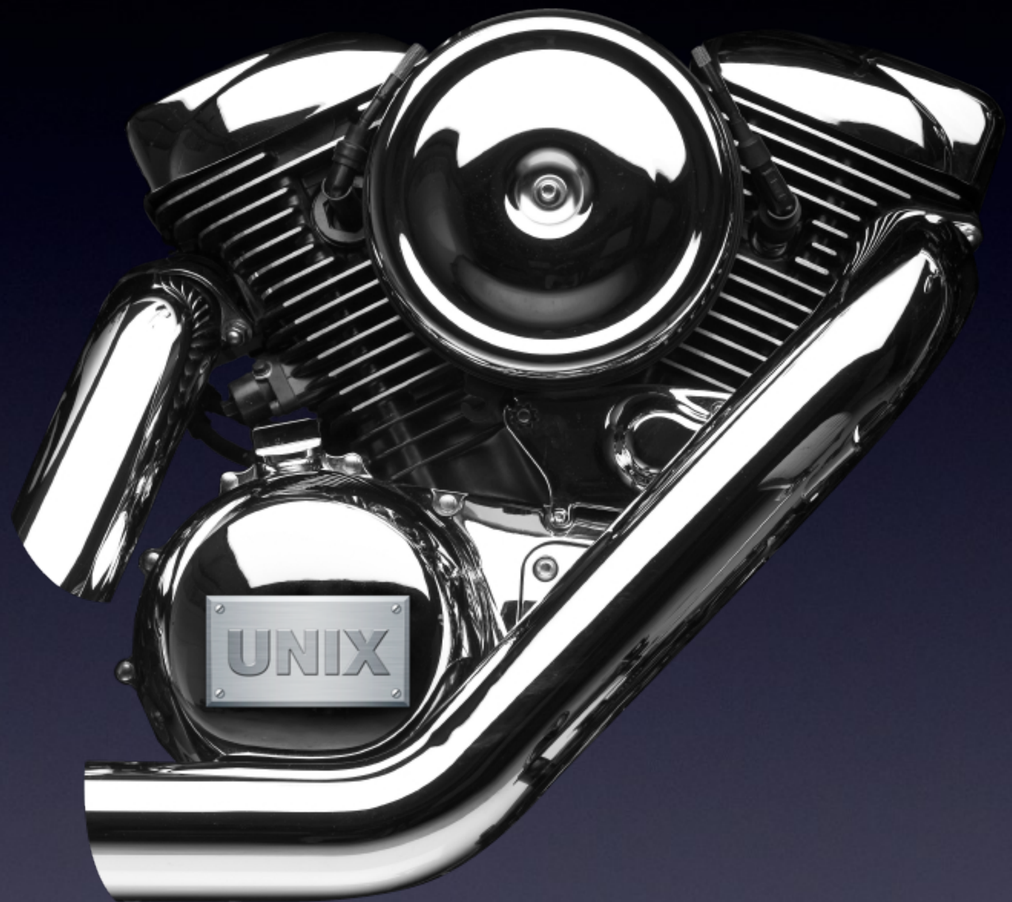
VP, Core OS Engineering

Core OS

OS X
Foundation Technology

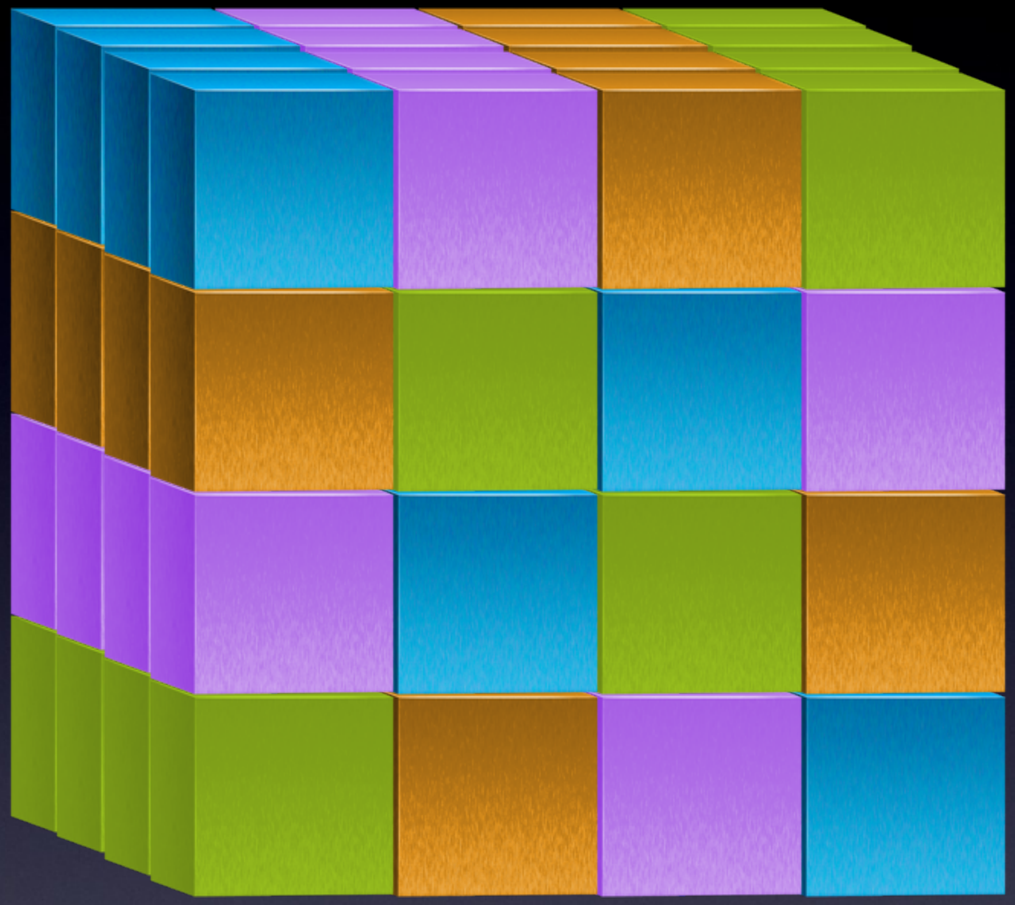
Stable Foundation

Stable Foundation



Engine of OS X

Proven Architecture



Modular Extensible Scalable

UNIX

Open Source

400 Projects

UNIX

Portable

System

Application

Shared APIs

10.6

3.0

CoreData

Cocoa

AppKit

Quartz

CoreFoundation

POSIX

CoreAudio

CoreLocation

UIKit

85% iPhone OS APIs shared with Mac OS X

> 1400 additional shared APIs

Stable Foundation
Built for Innovation

Foundation Technology

Technology

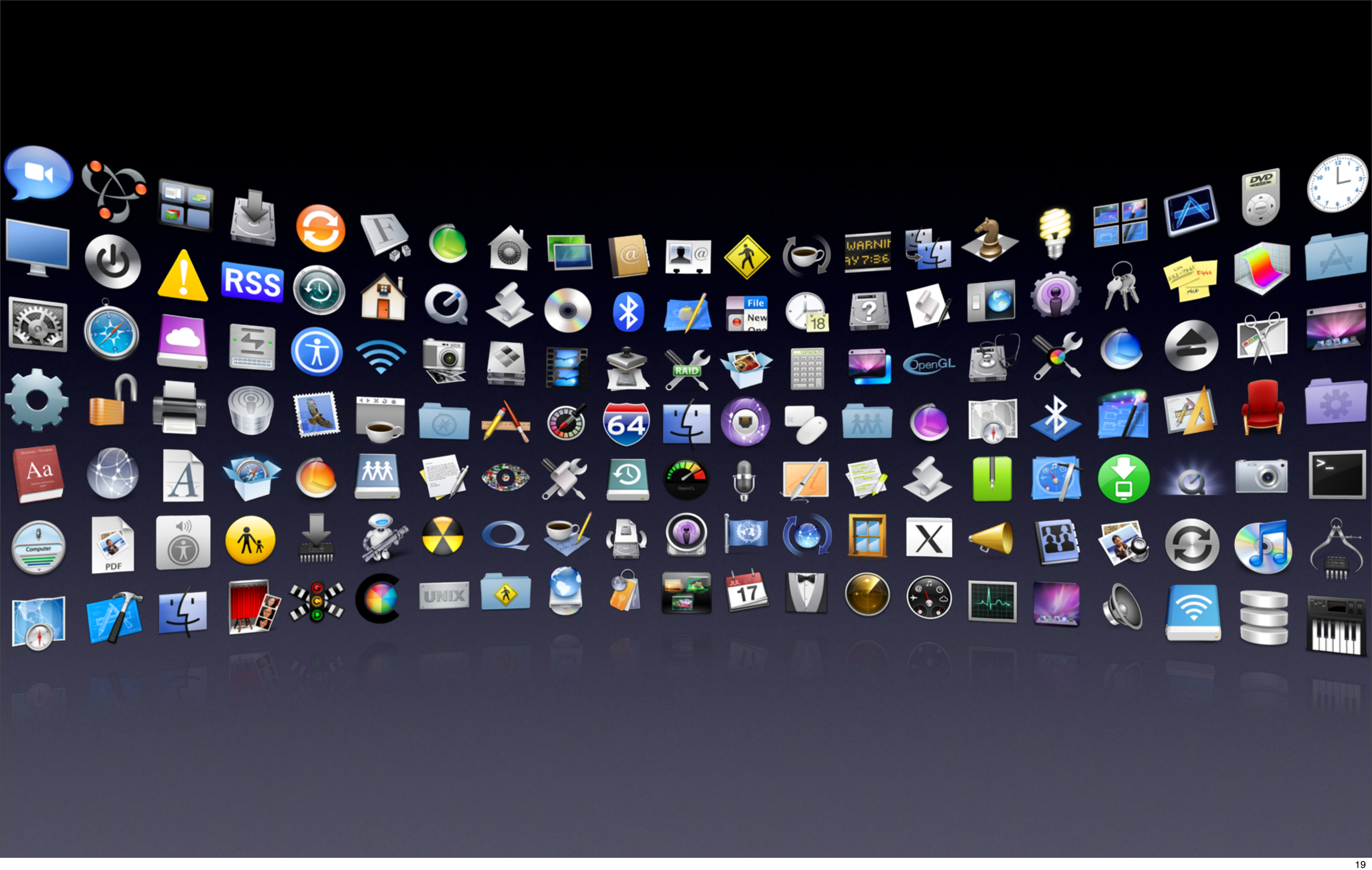
Time Capsule

100GB

Typical initial backup size

55%
FASTER

Time Capsule


RSS
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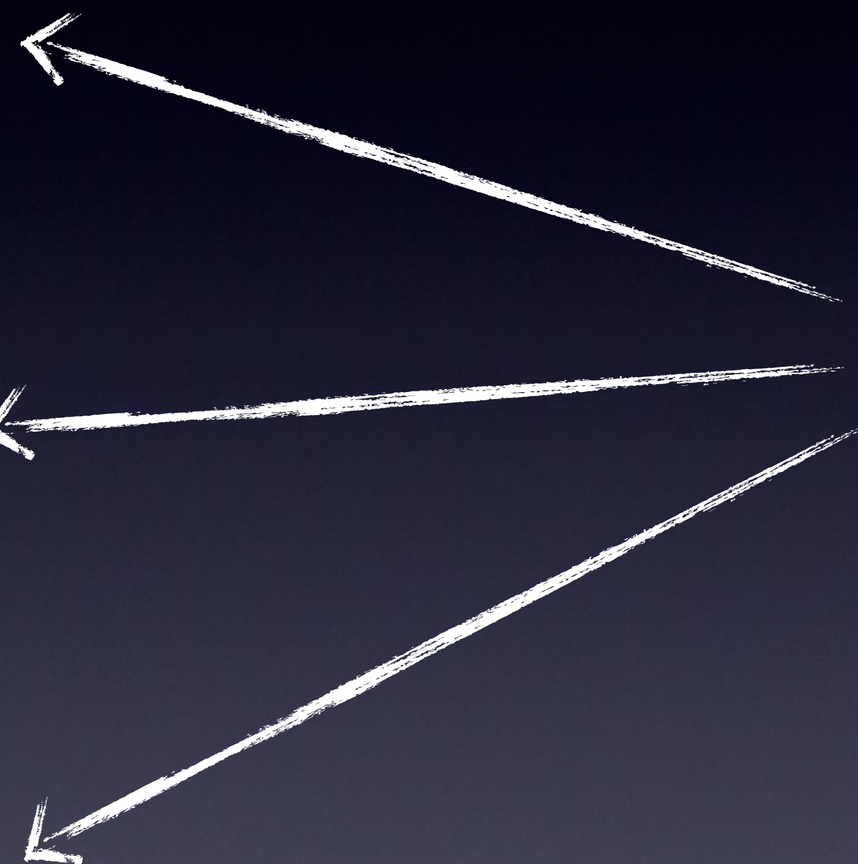
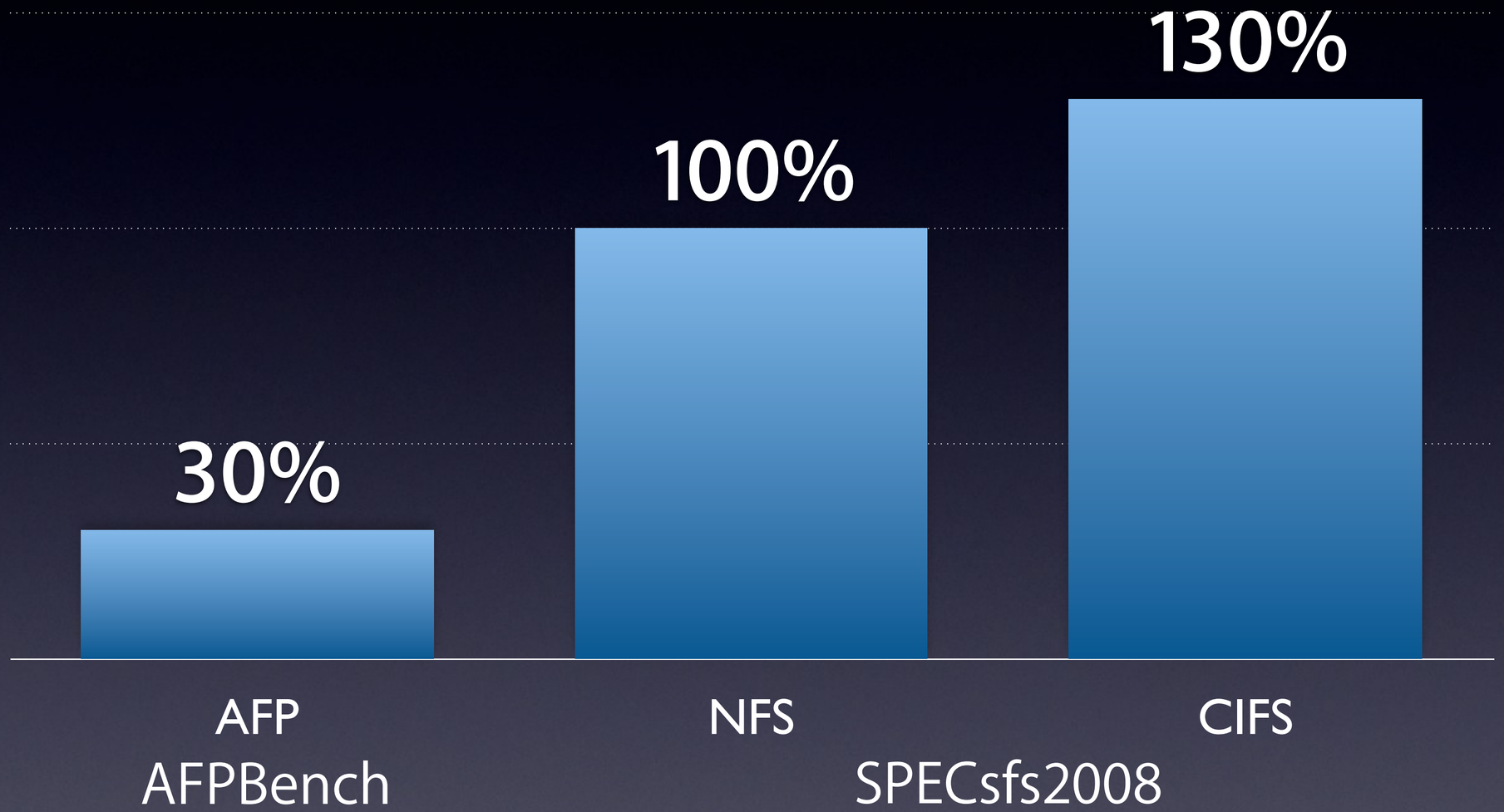
RAID
OpenGL
64
Aa
Computer
PDF
UNIX
17

Server Performance

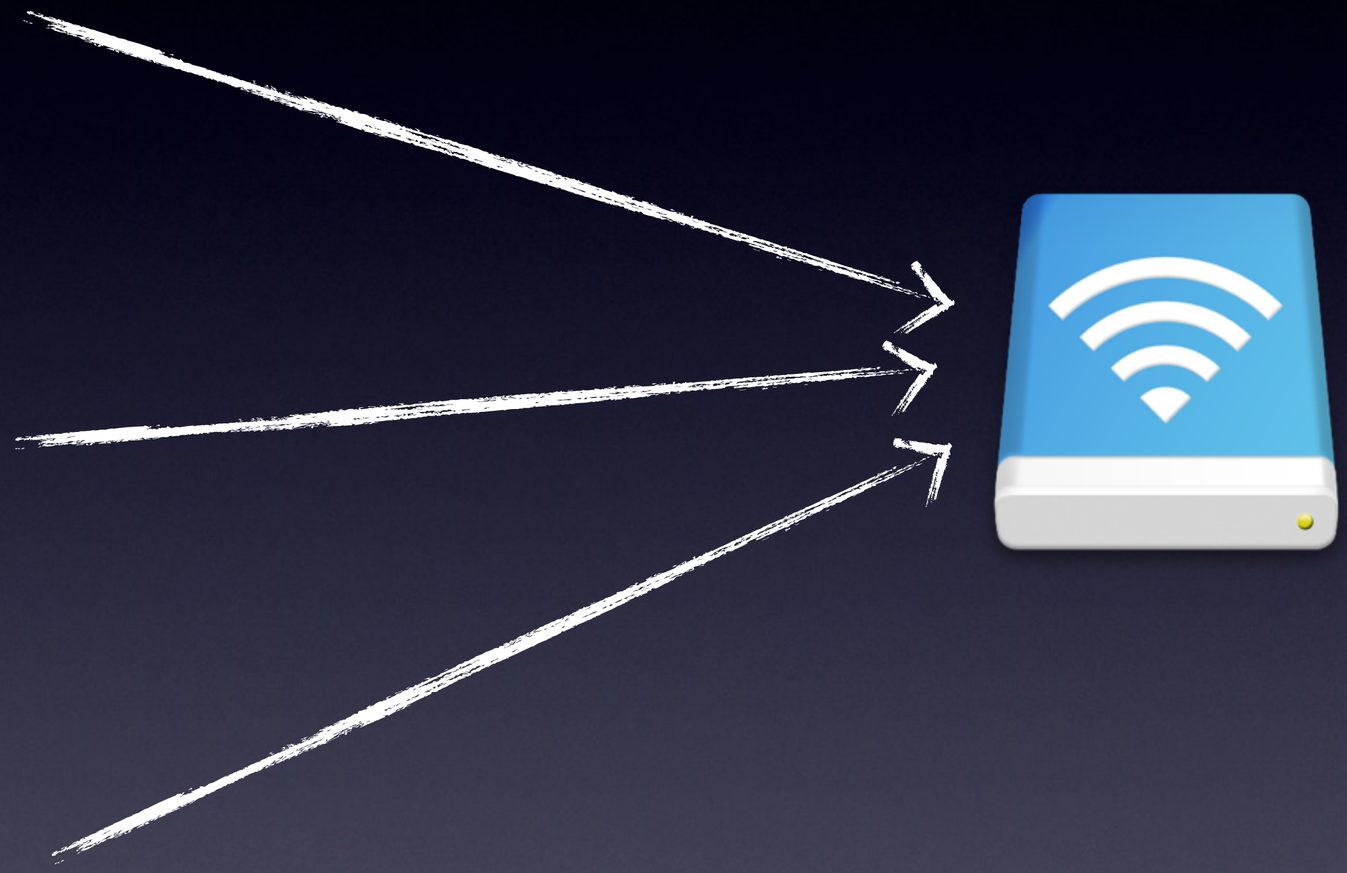


Server Performance



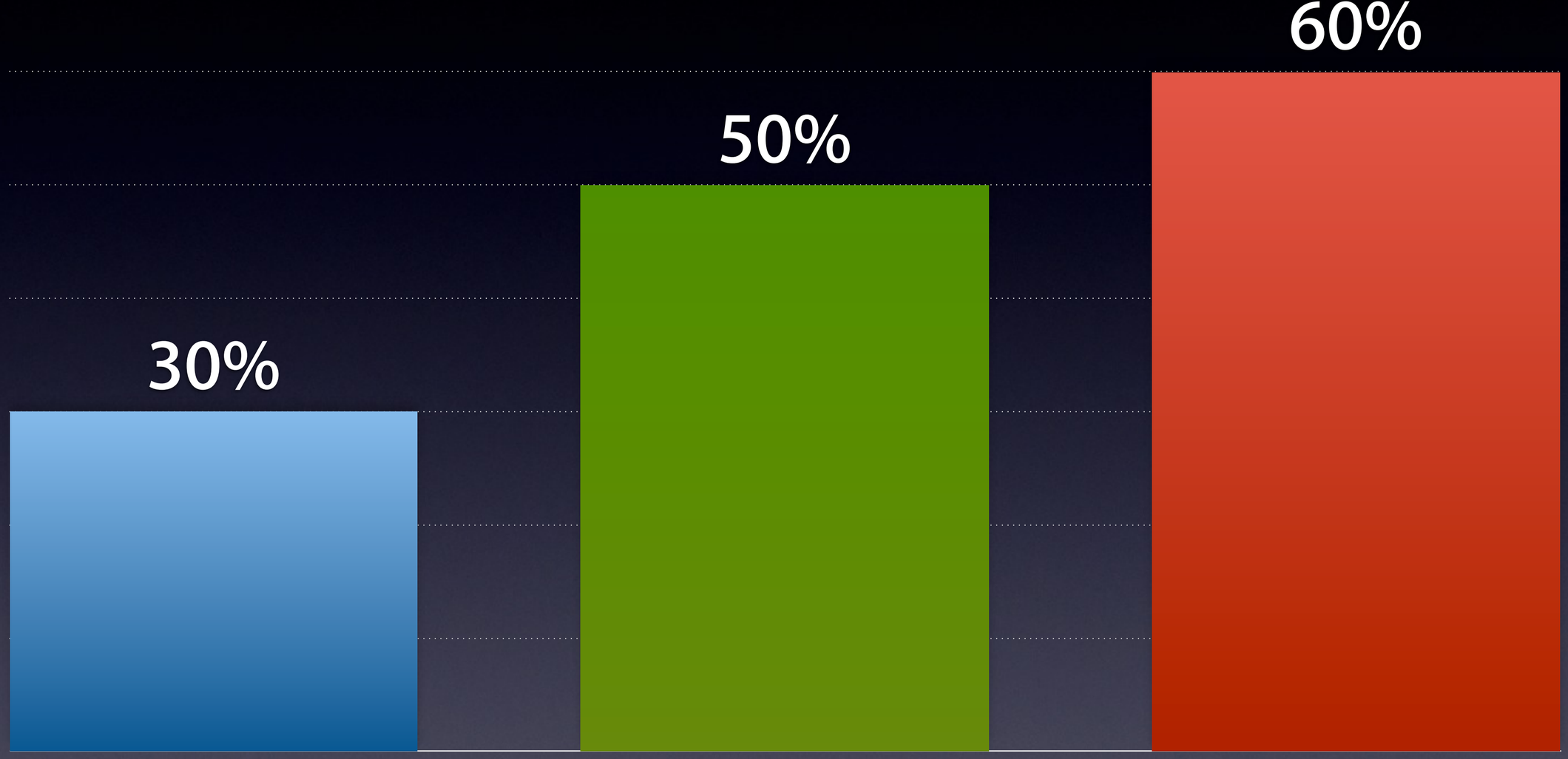
Testing conducted by Apple in May 2009 using a 2.93GHz 8-core Xserve (Early 2009) with 48GB RAM, a 4-port 4-Gbps Fibre Channel adapter, a SmallTree 6-port Gigabit Ethernet adapter, and 4 Promise VTrak E-class RAID arrays, each with 16 300GB 15,000-rpm SAS drives, running a shipping version of Leopard Server v10.5.7 and a prerelease version of Snow Leopard Server. Testing with Leopard Server v10.5.7 reported 19,313 SPECsfs2008_cifs ops per second with an overall response time of 1.89 ms and 9189 SPECsfs2008_nfs.v3 ops per second with an overall response time of 2.18 ms. Testing with Snow Leopard Server reported 44,347 SPECsfs2008_cifs ops per second with an overall response time of 1.89 ms and 18,784 SPECsfs2008_nfs.v3 ops per second with an overall response time of 2.67 ms. SPEC® and the benchmark name SPECsfs2008™ are trademarks of the Standard Performance Evaluation Corporation (SPEC); see www.spec.org for more information. Competitive benchmark results stated here reflect internal Apple testing and were submitted to SPEC in May 2009. Performance tests are conducted using specific computer systems and reflect the approximate performance of Xserve and Mac OS X Server.

Client Performance



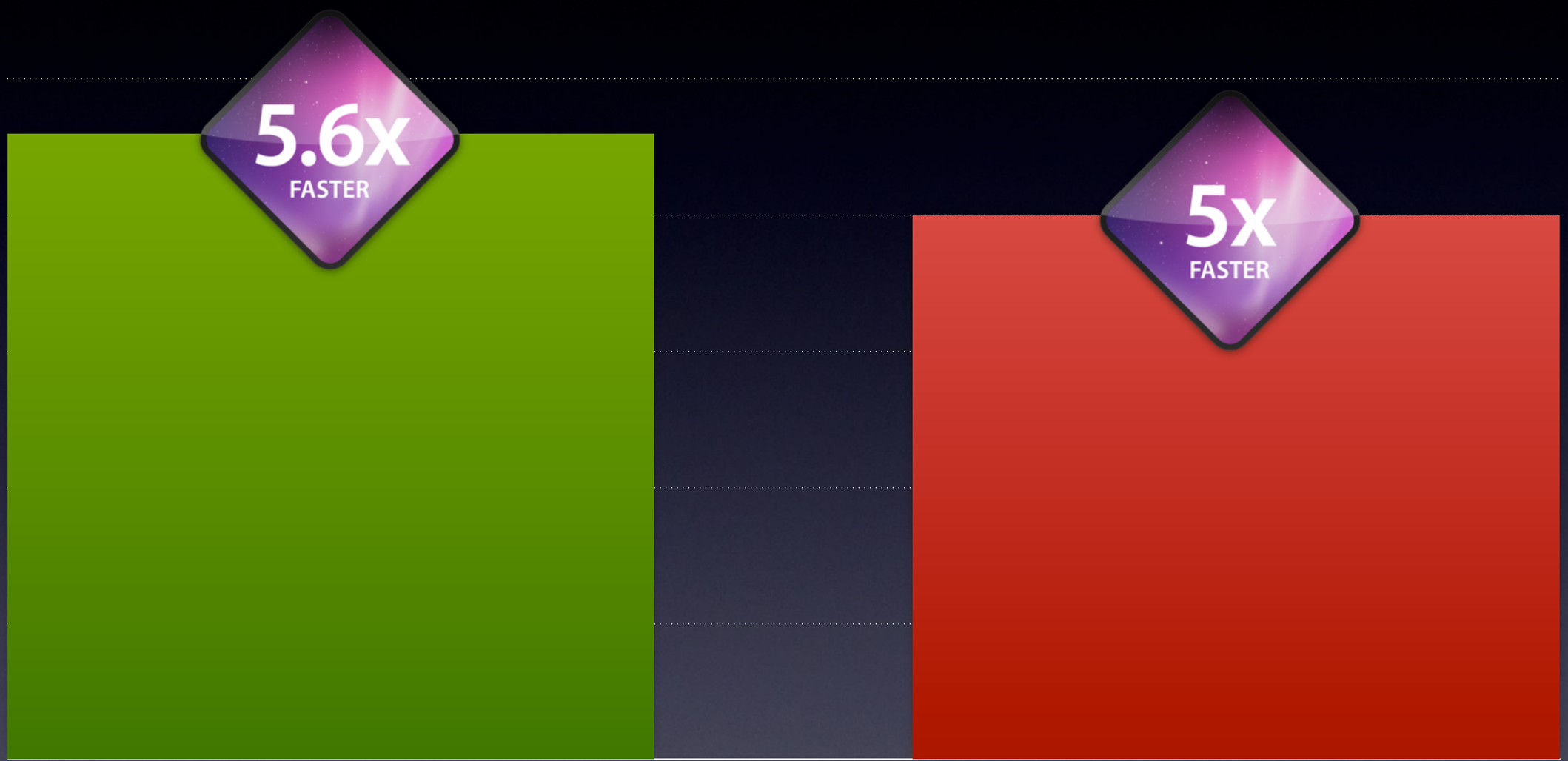
Client Performance

File Copy



Client Performance

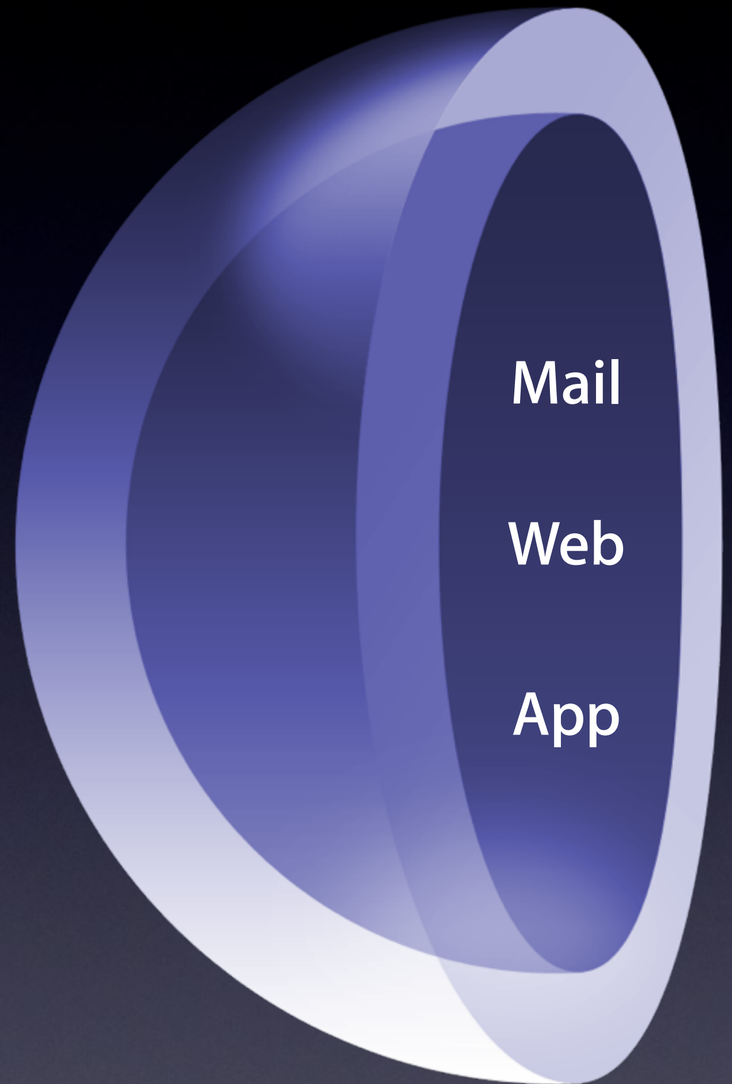
Directory Enumeration



RSS
File
New
RAID
OpenGL
64
Aa
Computer
PDF
UNIX
17

VPN

3G
9:42 AM
SMS
Text
Tuesday
9
Calendar
Photos
Camera
YouTube
Stocks
280
Maps
73°
Weather
Clock
Calculator
Notes
Settings
iTunes
App Store
Phone
Mail
Safari
iPod


Mail
Web
App

VPN

3G
9:42 AM
Settings
Airplane Mode
OFF
Wi-Fi
Not Connected
VPN
VPN
OFF
Fetch New Data
Push
Sounds
Brightness
Wallpaper
General

Mail
Web
App

VPN

3G
9:42 AM
SMS
Text
Tuesday
9
Calendar
Photos
Camera
YouTube
Stocks
280
Maps
73°
Weather
Clock
Calculator
Notes
Settings
iTunes
App Store
Phone
Mail
Safari
iPod

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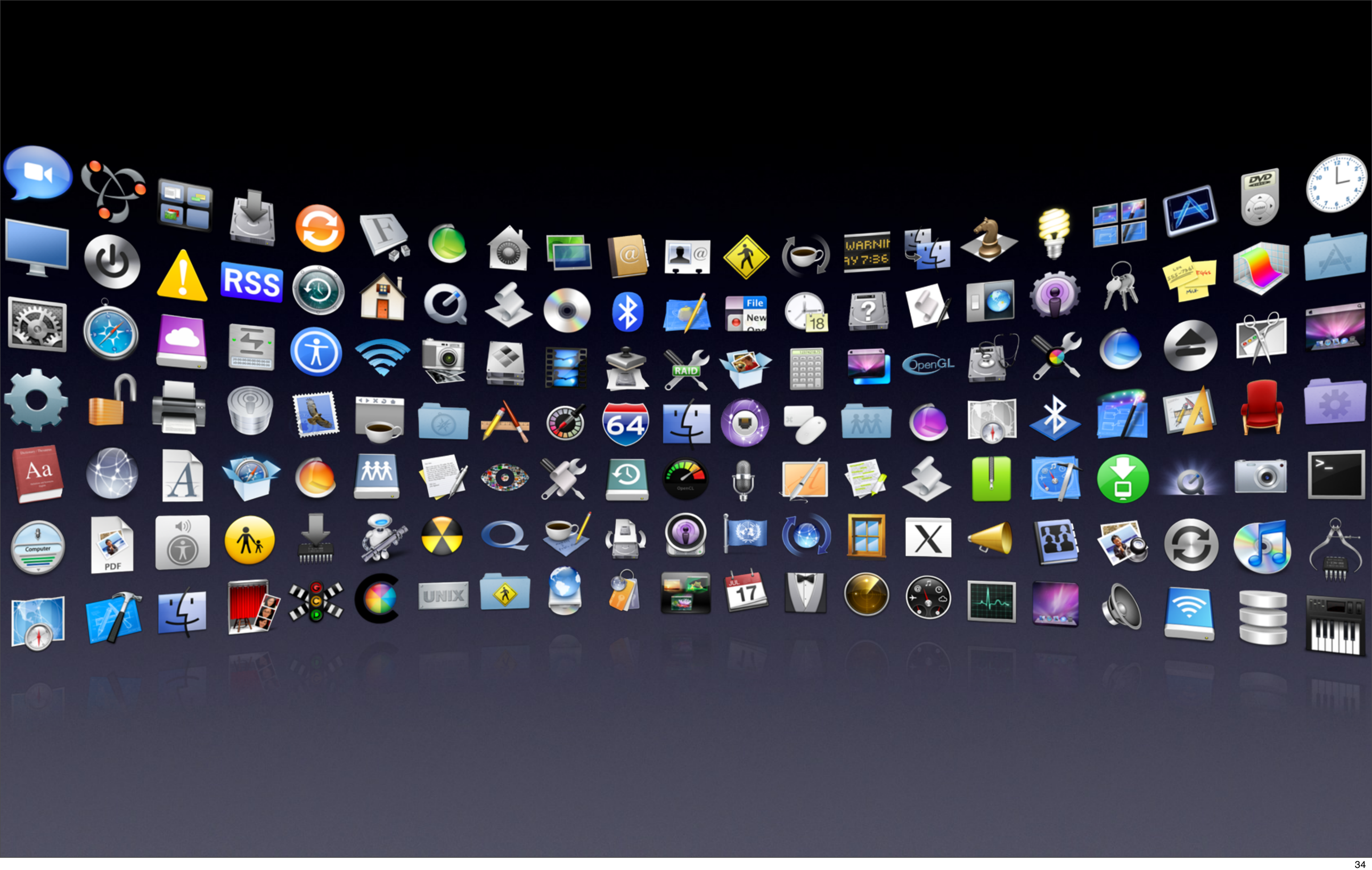
mail.myenterprise.com


RSS
File
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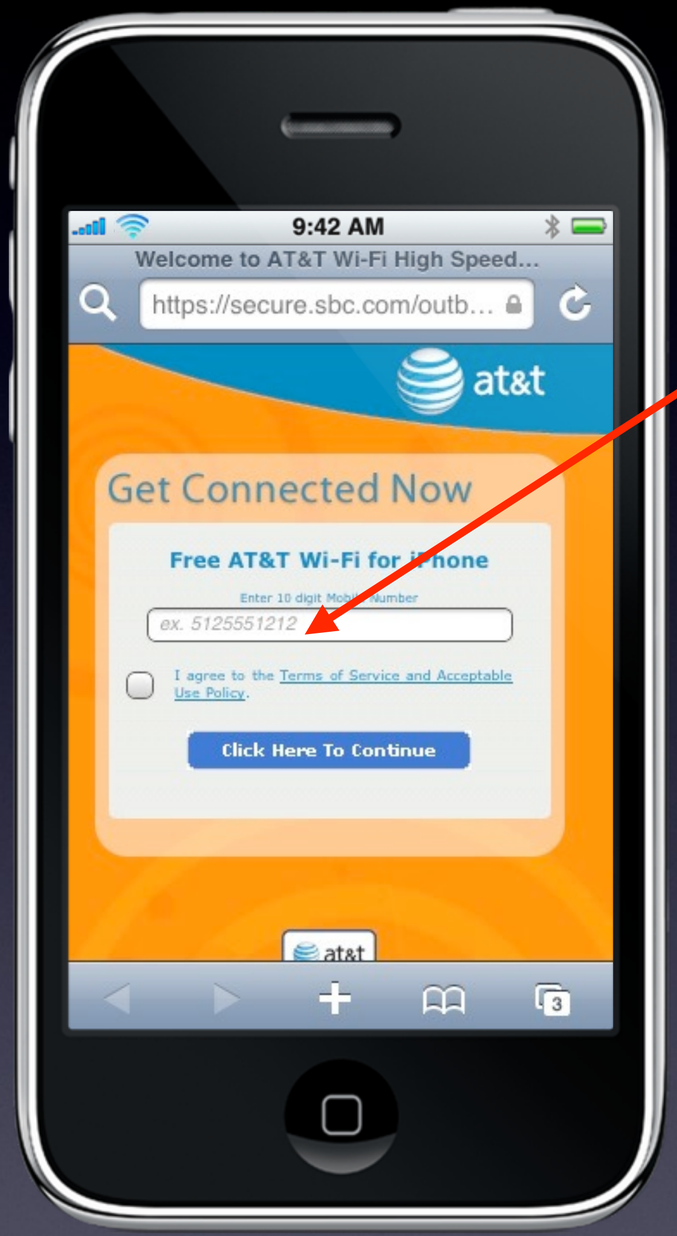
RAID
OpenGL
64
Aa
Computer
PDF
UNIX
17

Hotspots

Hotspots

9:42 AM
Mailboxes
Inbox (3)
Edit
Kirk
9:39 AM
Urgent
Stella, I know you're out sick today, but can you look at this proposal?
Lance
9:14 AM
Back from paradise?
You lucky devils missed the storm. This is what our house looked like last week.
Lana
8:56 AM
Specs
Hi there. Here are the designs for the new shop. I am leaning toward the 60s look...
Britt
Yesterday
Directions to BBQ
Hi S. Here are directions to the smoke-out on Saturday. Don't forget to bring your...
George
Yesterday
Big news
Hey jet-setter. Call when you're back.
Updated 1/09/07 9:42 AM

Hotspots



Phone number

Password

Captive Networks

Test URL

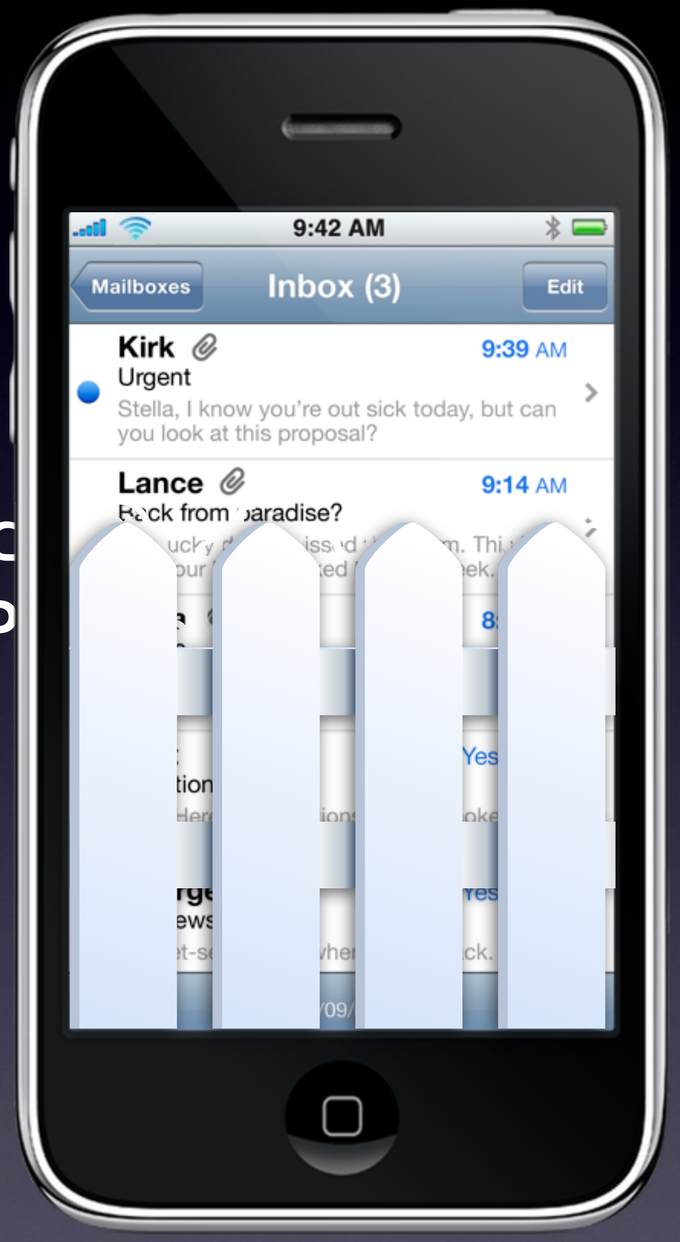
Username/Password

Login Page

username=”cooldude@cafecool.com”
password=”iPhoneRocks”

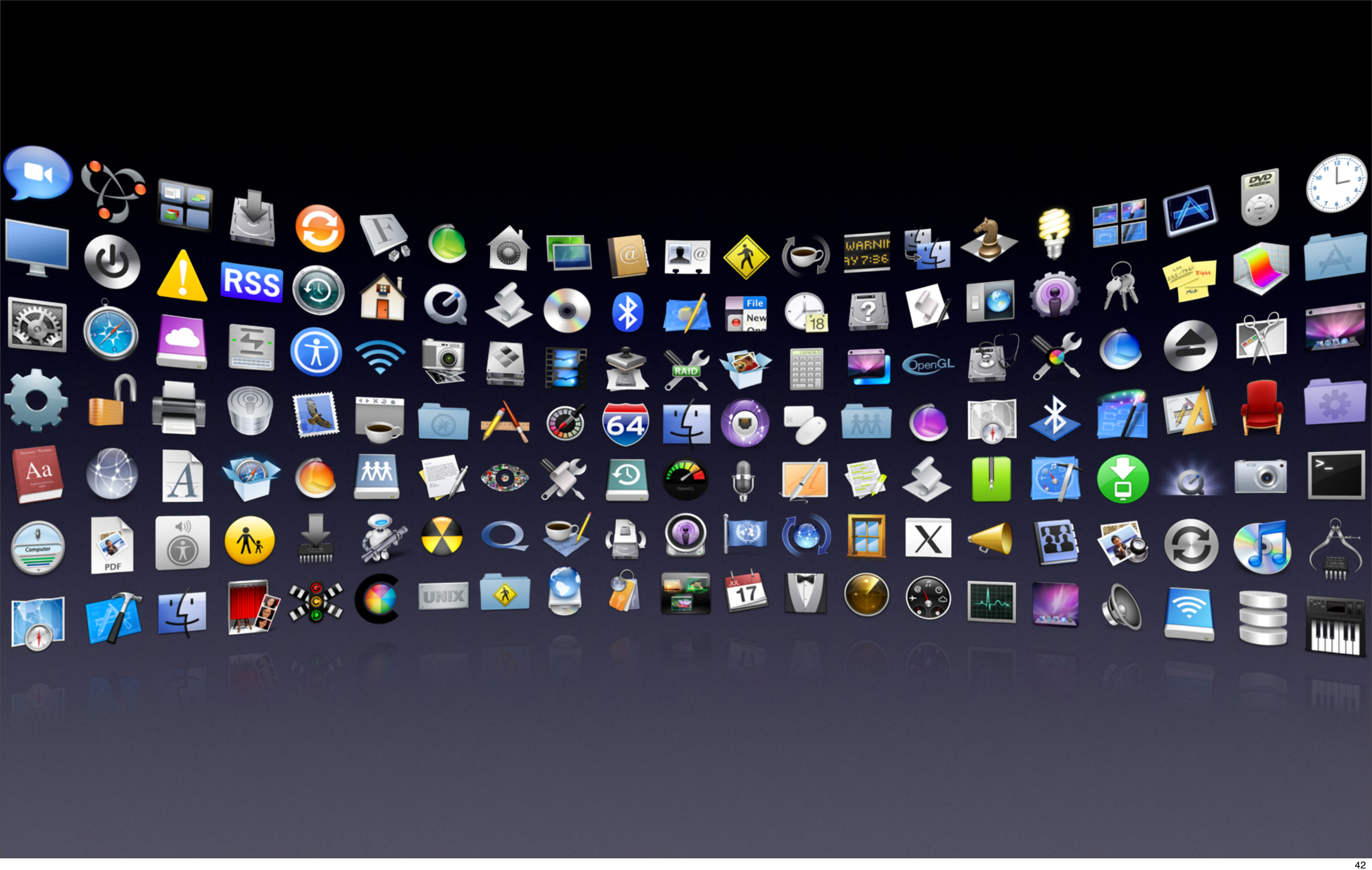
A second cup of coffee

WISPr



Test URL

Login Page


RSS
File
New
RAID
OpenGL
64
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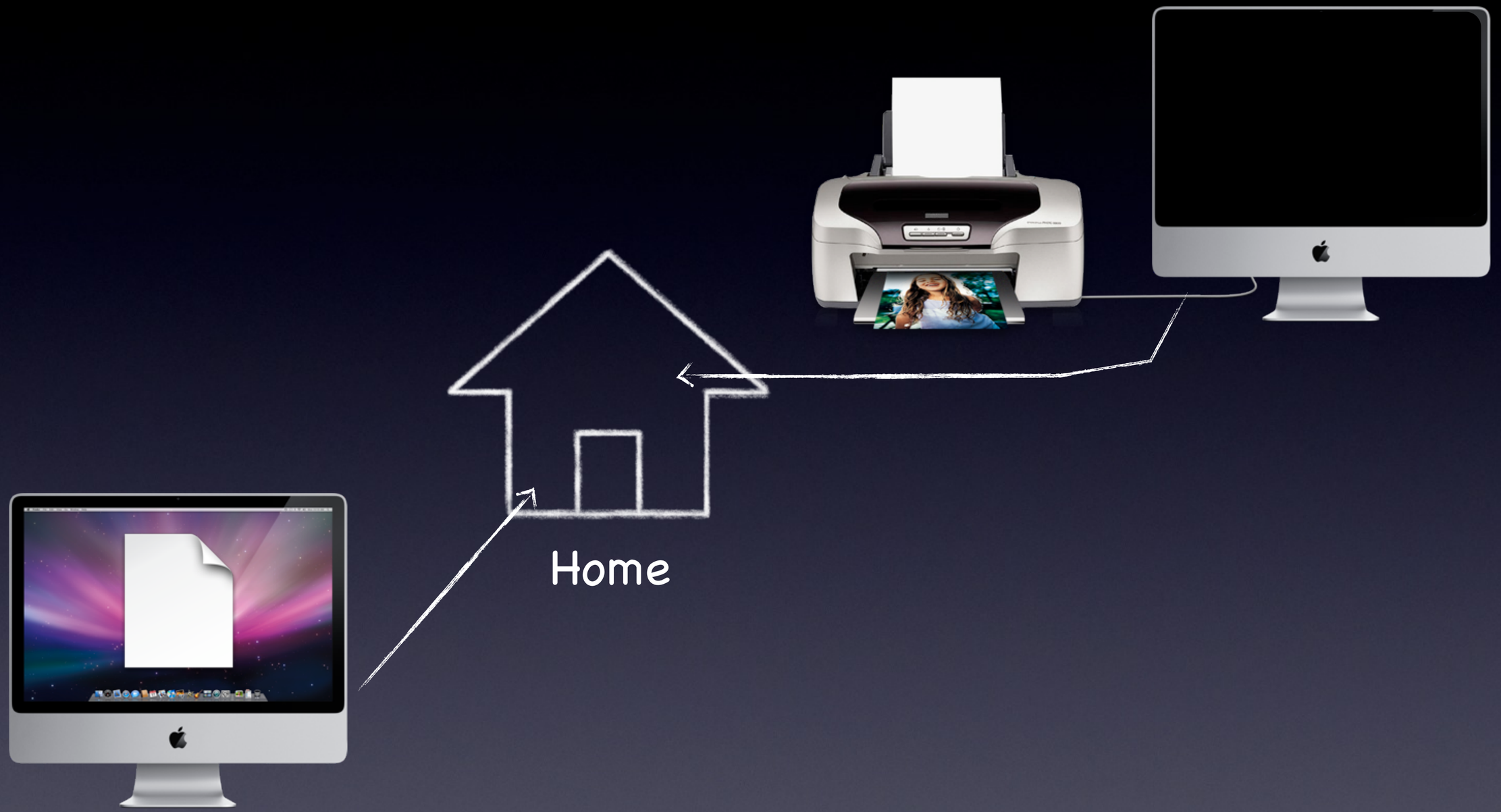
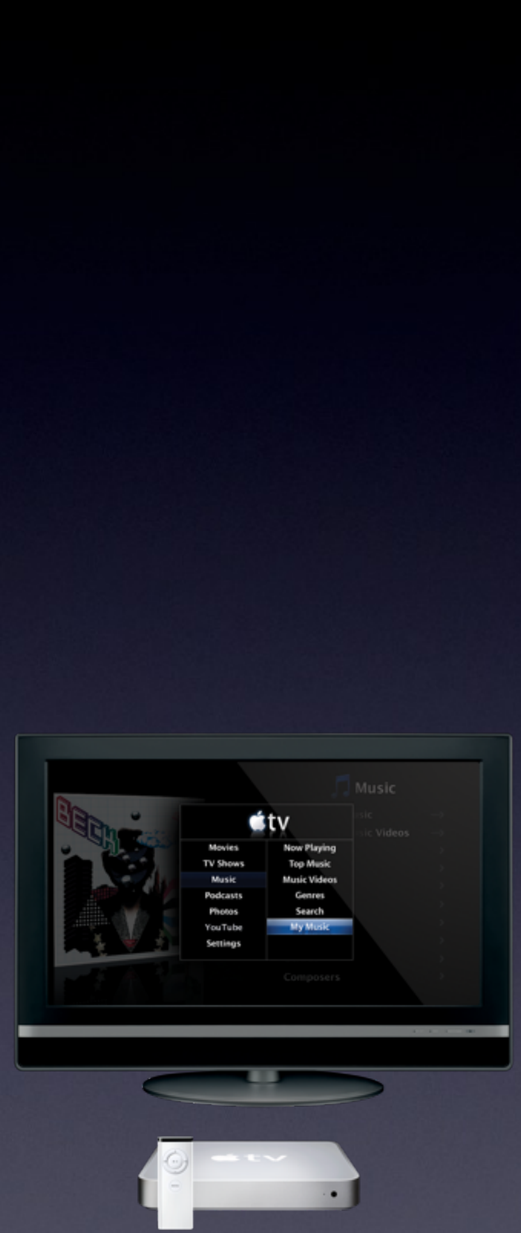
Computer
PDF
UNIX
17
DVD

I Have a Sleeping Problem

Printing Sleeping Problem

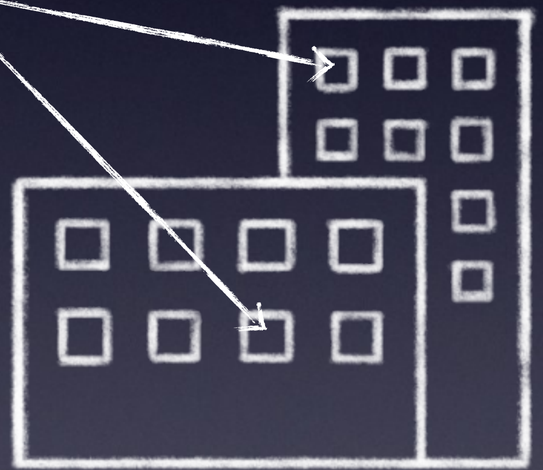


iTunes Streaming Sleeping Problem



Home

Back to My Mac Sleeping Problem

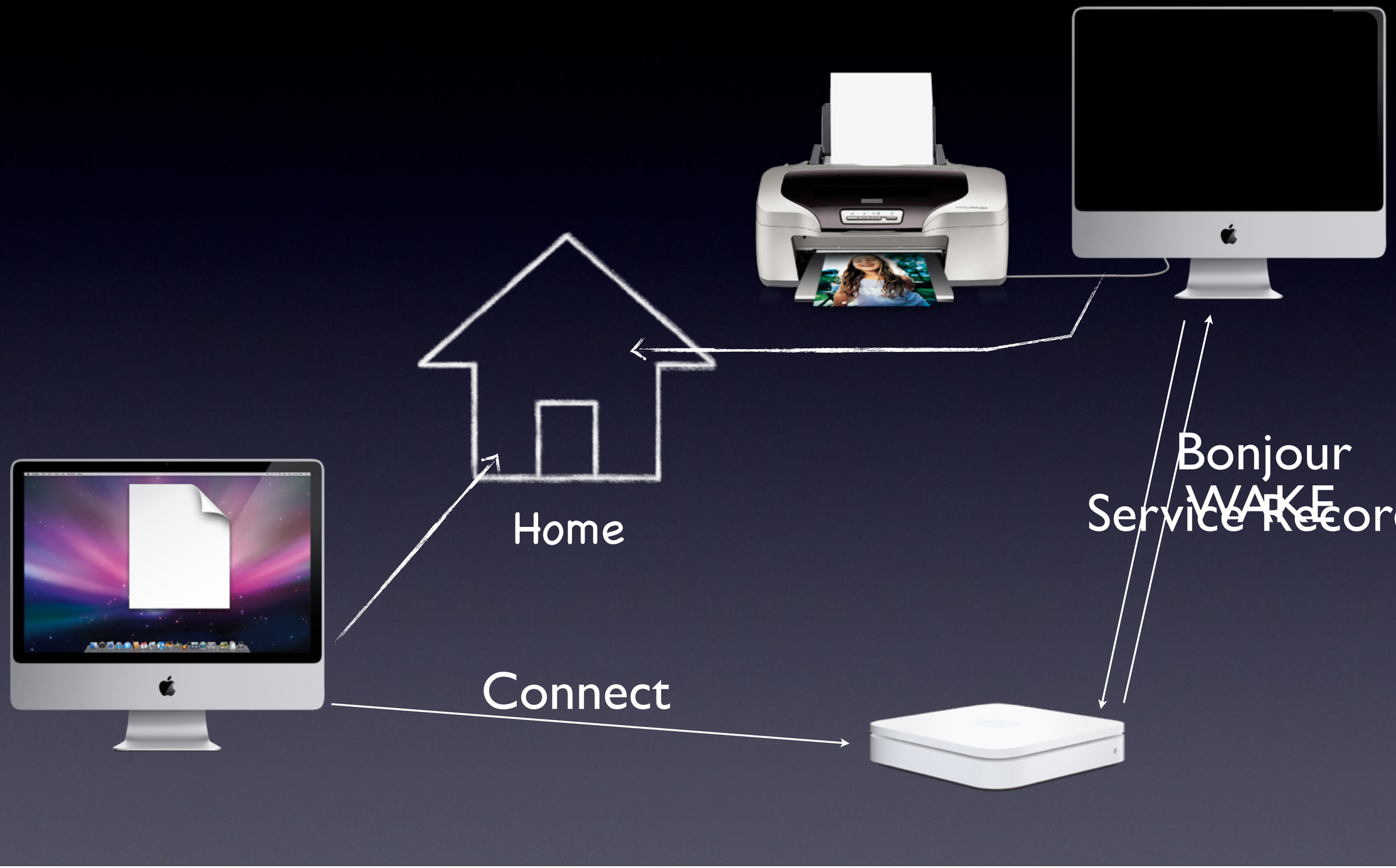


Office

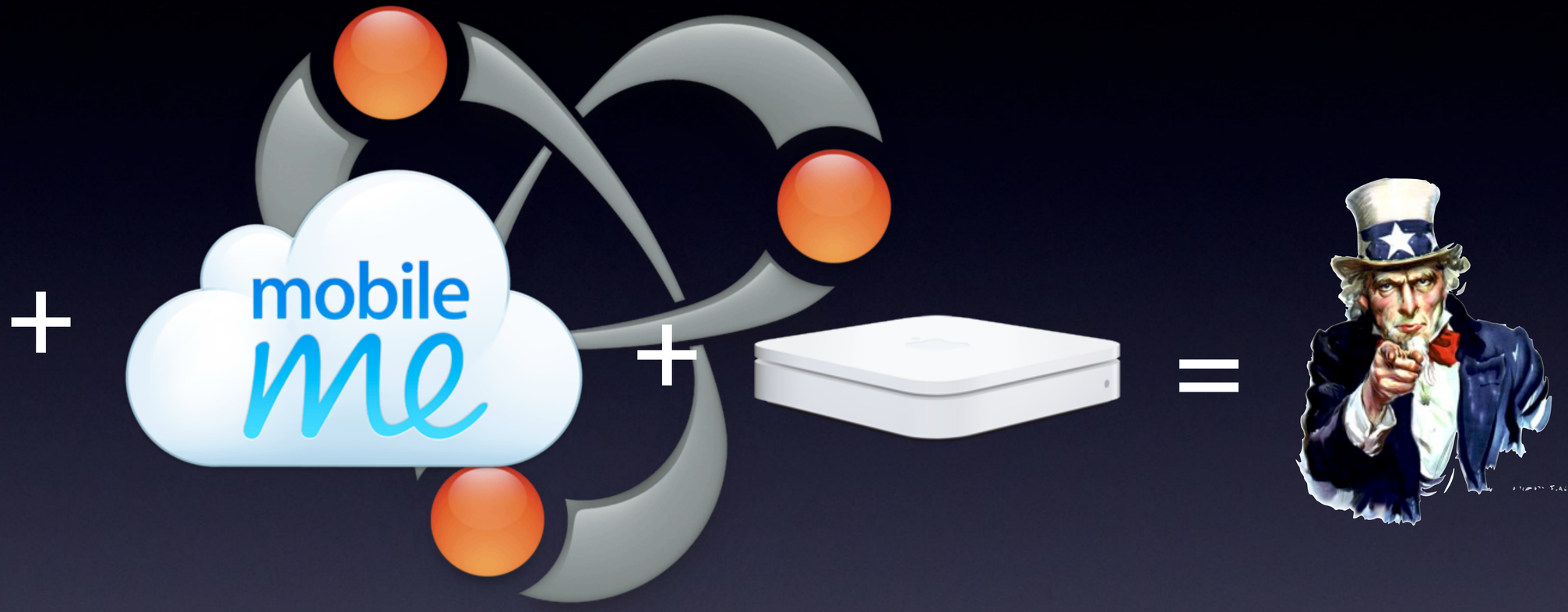
Home

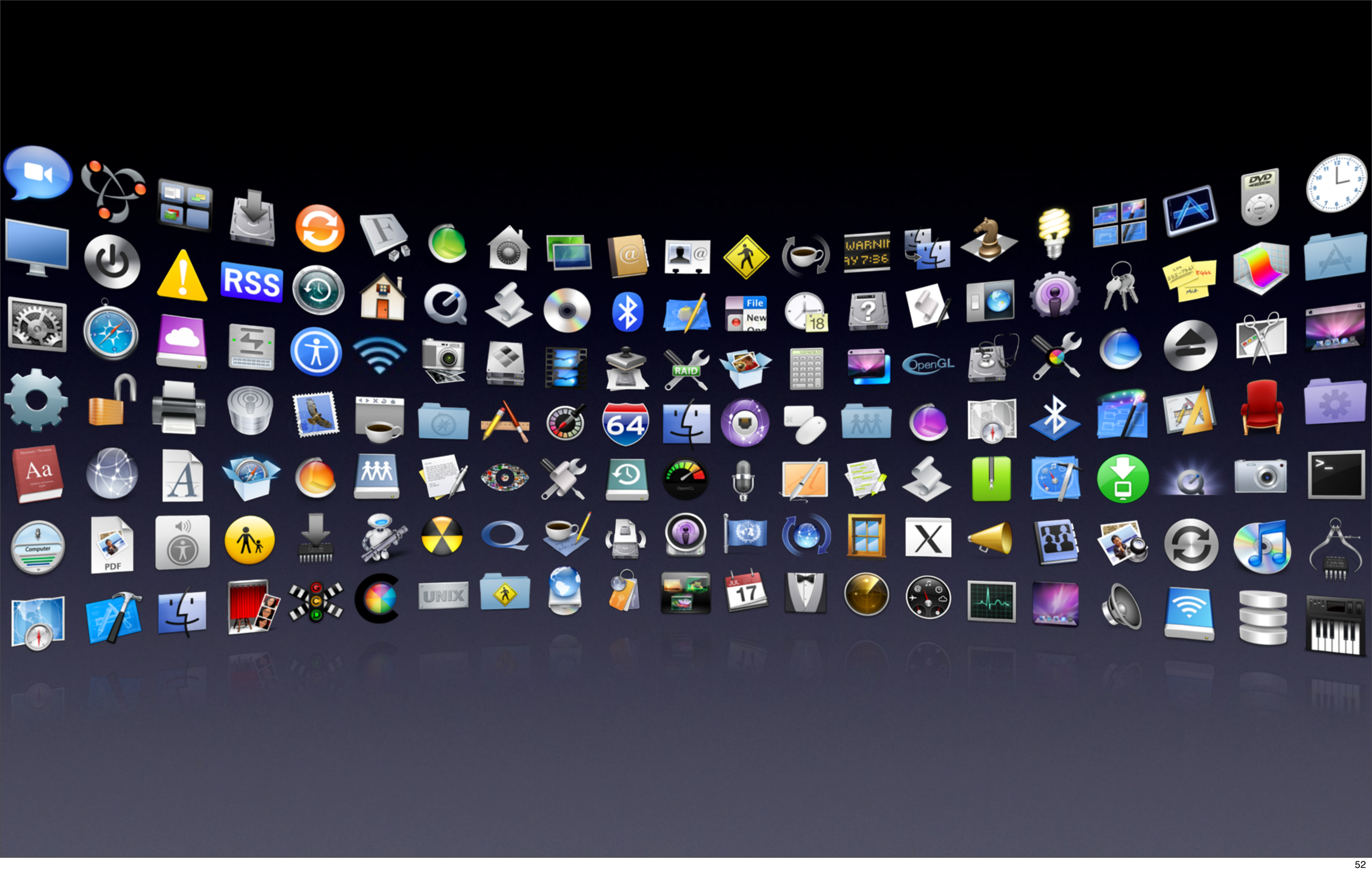
Powerful Sleeping Problems

Bonjour Sleep Proxy



What do you need to do?




RSS
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3.0
3.5
4.0
GHz

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1.0
1.5
2.0
2.5
3.0
3.5
4.0
GHz

Threads are Hard

Grand Central Dispatch

Goals

Multicore programming model

Break app into blocks of work

OS gets the work done

New MultiCore Engine

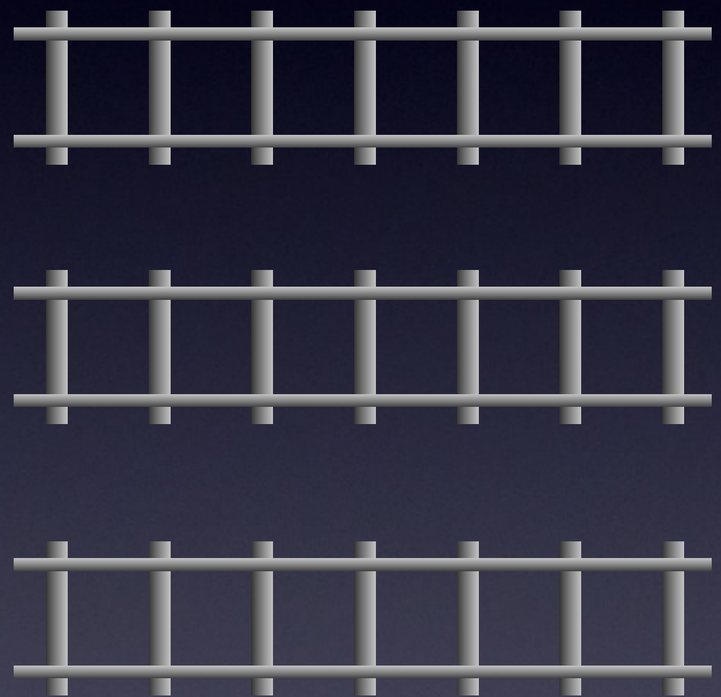
Ultra fast user space scheduler

Optimal thread management

Simplified event handling

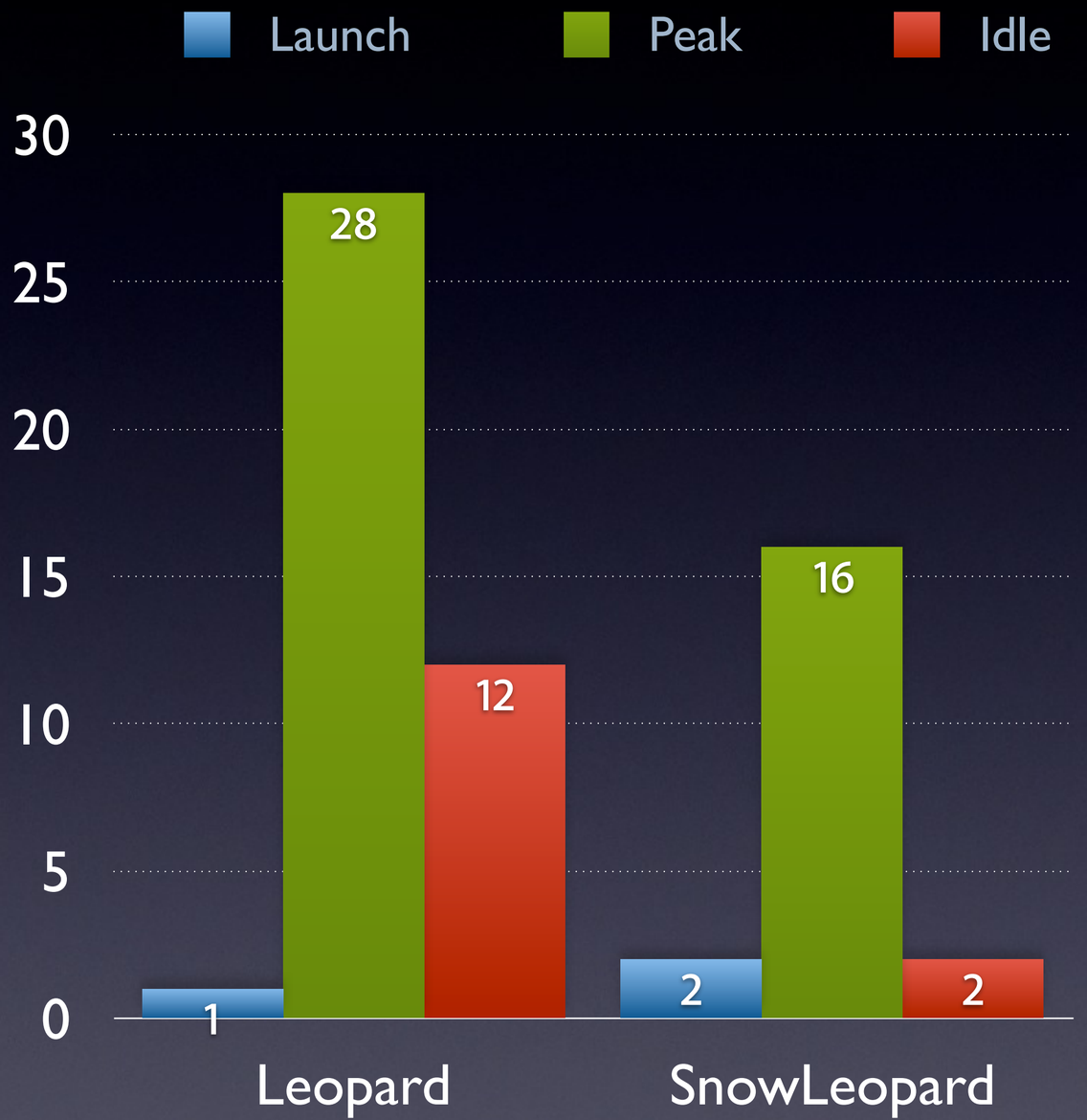
Simple synchronization

Resource Blocks Moving Element



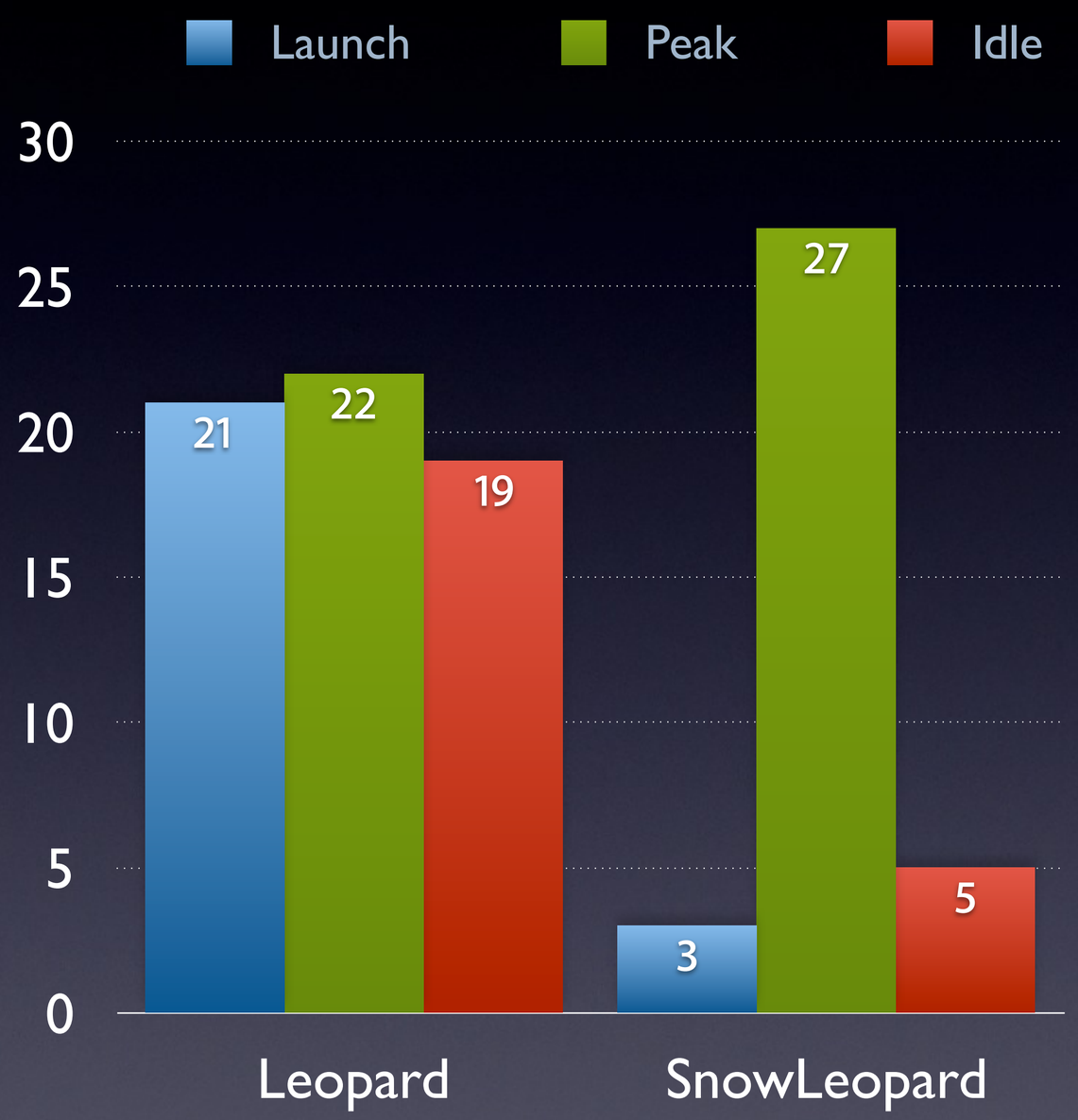
Thread Usage

Preview



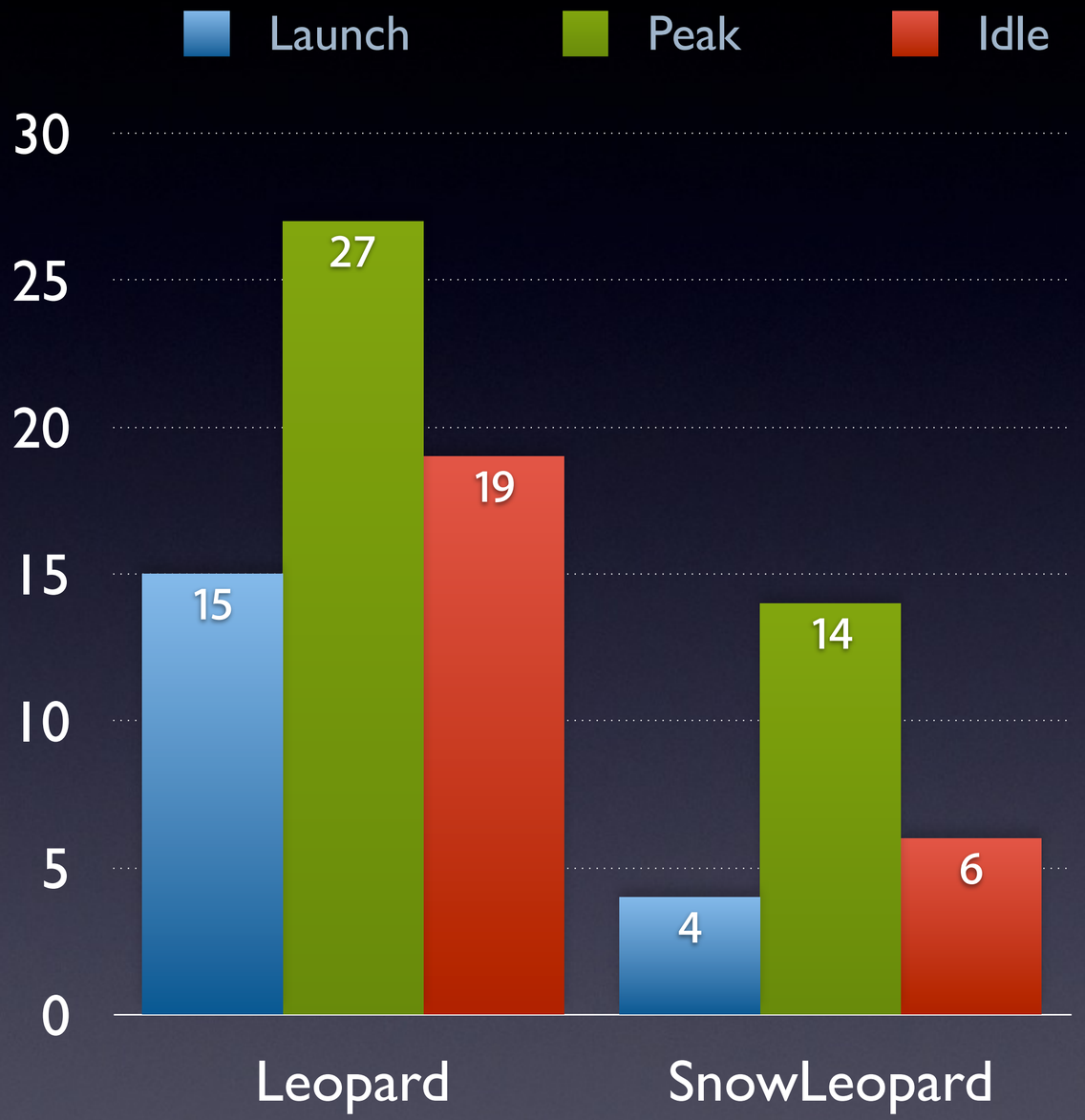
Thread Usage

Mail



Thread Usage

iChat



Highly Tuned Engine

Low overhead

Lockless scheduling

Wait free algorithms

Scales up

Scales down

Comprehensive Solution

Multicore engine

Language extension

Object oriented framework

New system-wide APIs

Tools

Language Extension
Blocks

```
voi  (^func)(voic  blockptr;

blo  kptr = ^{ pri  tf("Hello world\n"); }
```

Object Oriented Framework

NSOperation

Dispatch

New System Wide APIs

LibNotify

OpenDirectory

AudioToolbox

SCDynamicStore

FSEvents

SCNetworkConnection

CFMessage

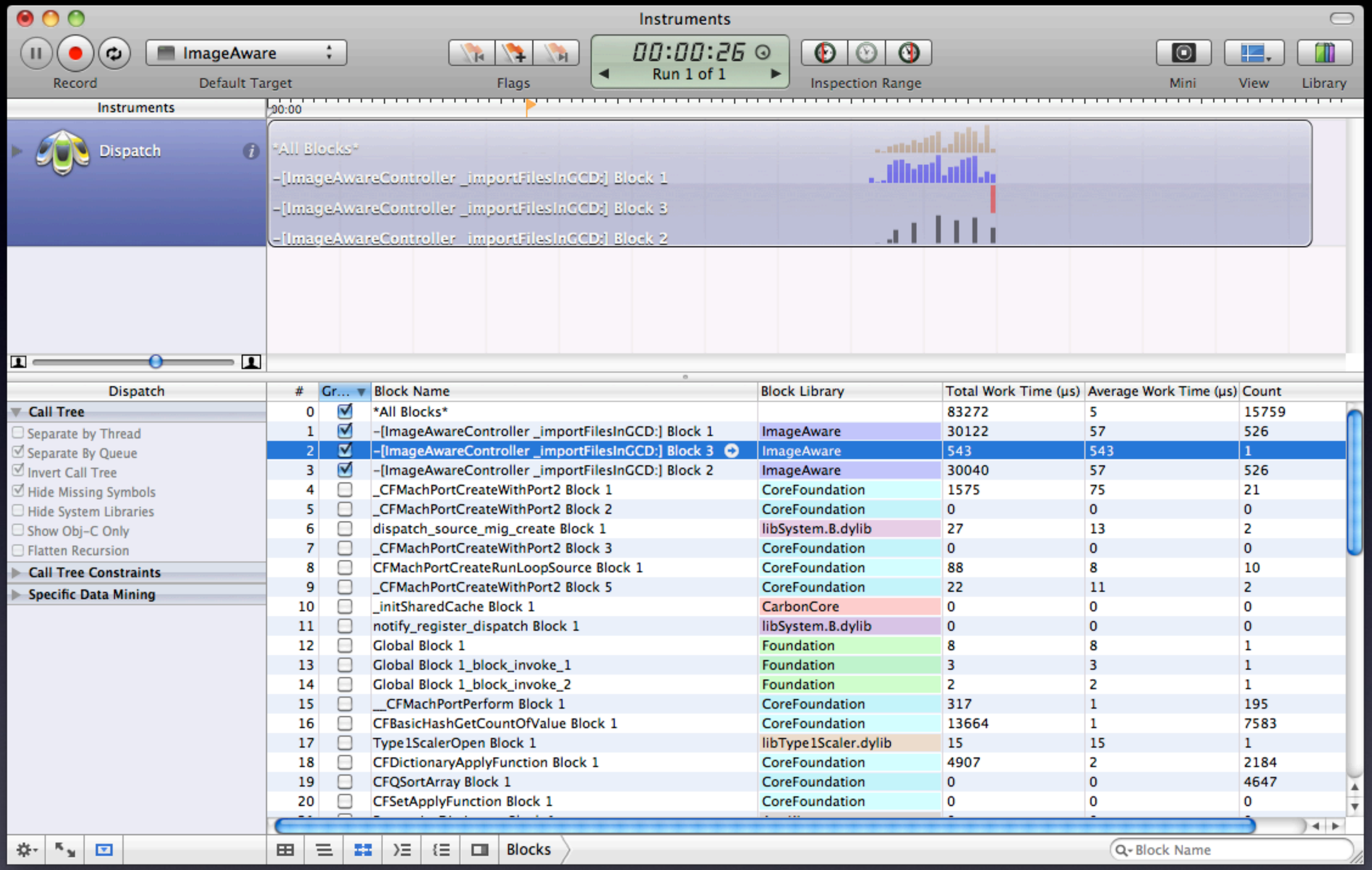
SCNetworkReachability

Metadata

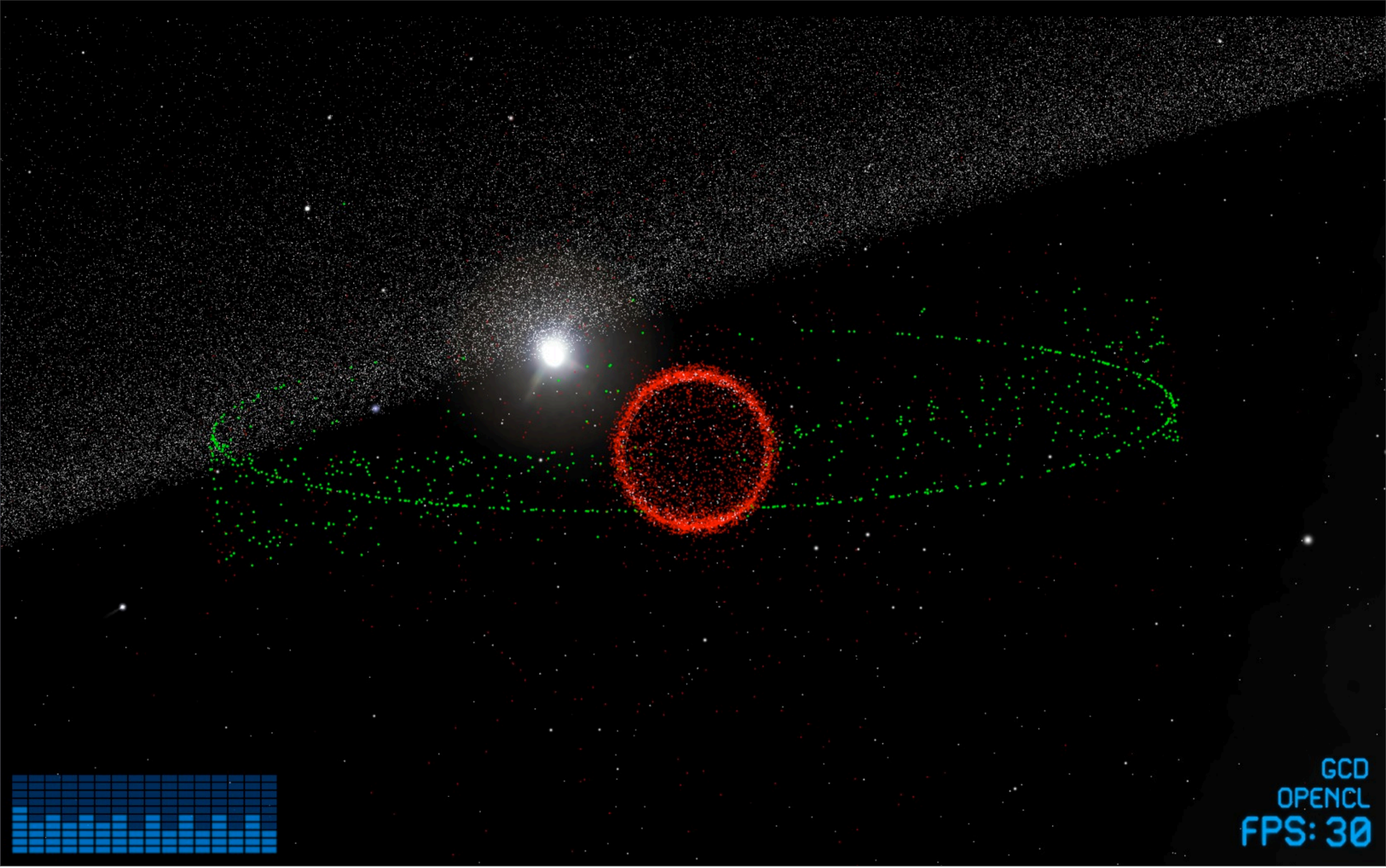
SCPreferences

Integration of Event Sources

Tools



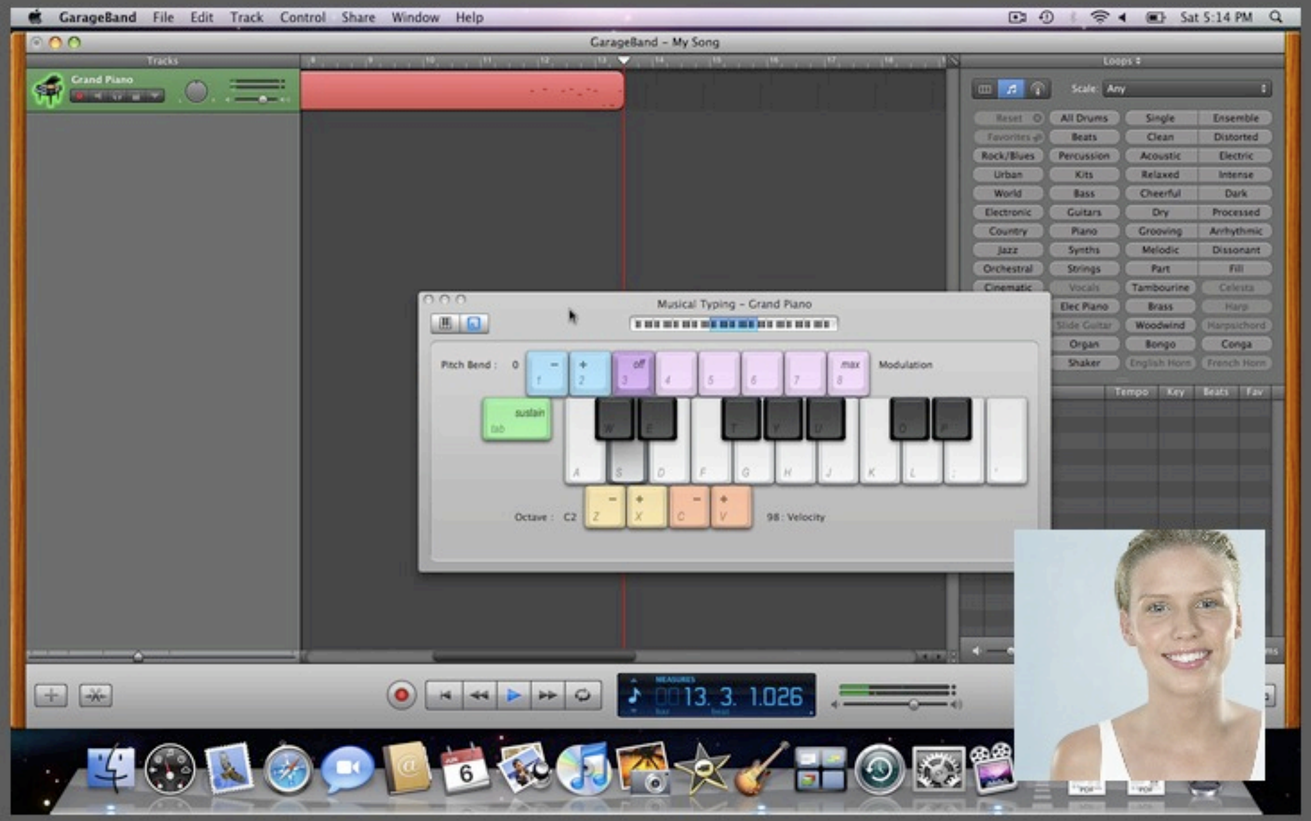
#	Gr...	Block Name	Block Library	Total Work Time (µs)	Average Work Time (µs)	Count
0	☑	*All Blocks*		83272	5	15759
1	☑	-[ImageAwareController _importFilesInGCD:] Block 1	ImageAware	30122	57	526
2	☑	-[ImageAwareController _importFilesInGCD:] Block 3	ImageAware	543	543	1
3	☑	-[ImageAwareController _importFilesInGCD:] Block 2	ImageAware	30040	57	526
4	☐	_CFMachPortCreateWithPort2 Block 1	CoreFoundation	1575	75	21
5	☐	_CFMachPortCreateWithPort2 Block 2	CoreFoundation	0	0	0
6	☐	dispatch_source_mig_create Block 1	libSystem.B.dylib	27	13	2
7	☐	_CFMachPortCreateWithPort2 Block 3	CoreFoundation	0	0	0
8	☐	CFMachPortCreateRunLoopSource Block 1	CoreFoundation	88	8	10
9	☐	_CFMachPortCreateWithPort2 Block 5	CoreFoundation	22	11	2
10	☐	_initSharedCache Block 1	CarbonCore	0	0	0
11	☐	notify_register_dispatch Block 1	libSystem.B.dylib	0	0	0
12	☐	Global Block 1	Foundation	8	8	1
13	☐	Global Block 1_block_invoke_1	Foundation	3	3	1
14	☐	Global Block 1_block_invoke_2	Foundation	2	2	1
15	☐	__CFMachPortPerform Block 1	CoreFoundation	317	1	195
16	☐	CFBasicHashGetCountOfValue Block 1	CoreFoundation	13664	1	7583
17	☐	Type1ScalerOpen Block 1	libType1Scaler.dylib	15	15	1
18	☐	CFDictionaryApplyFunction Block 1	CoreFoundation	4907	2	2184
19	☐	CFQSortArray Block 1	CoreFoundation	0	0	4647
20	☐	CFSetApplyFunction Block 1	CoreFoundation	0	0	0


GCD
OPENCL
FPS: 30

ScreenFlow File Edit Insert Font Actions View Window Help

Sat 5:23 PM

GarageBand Tutorial



Video Properties

Scale:

X Rotation:

Y Rotation:

Z Rotation:

Opacity:

Reflection

Shadow

Angle:

Color:

Offset:

Opacity:

Blur Size:

Add Video Action

0s 0.5s 1s 1.5s 2s 2.5s 3s 3.5s 4s 4.5s 5s 5.5s 6s 6.5s 7s 7.5s 8s 8.5s 9s 9.5s 10s 10.5s

Built-in iSight

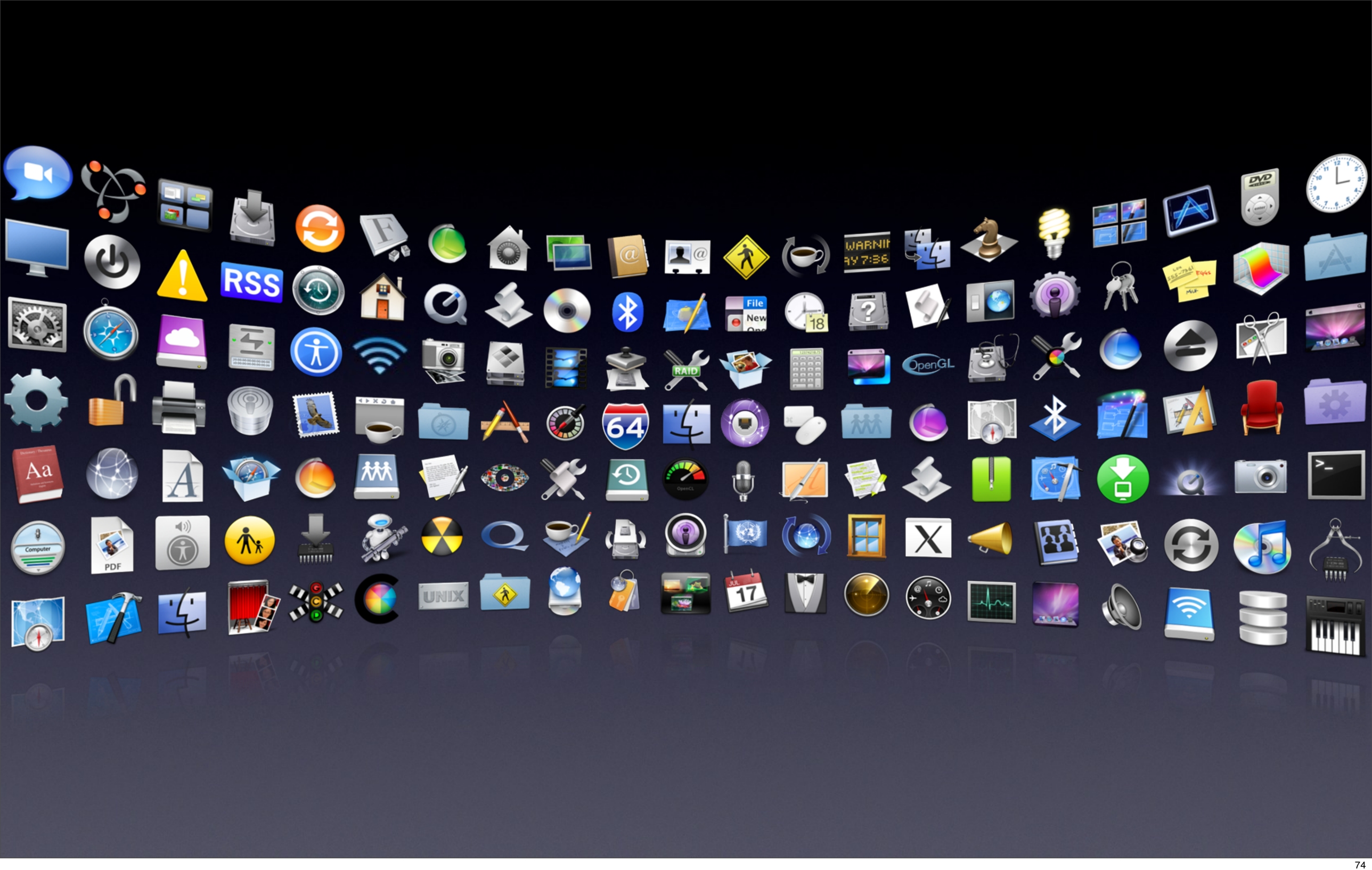
GarageBand Icon

Screen Recording 6/6/09

Welcome to the tutorial

Duration: 10 seconds

G
C
D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New
RAID
OpenGL
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Computer
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UNIX
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64

64-bit UNIX apps

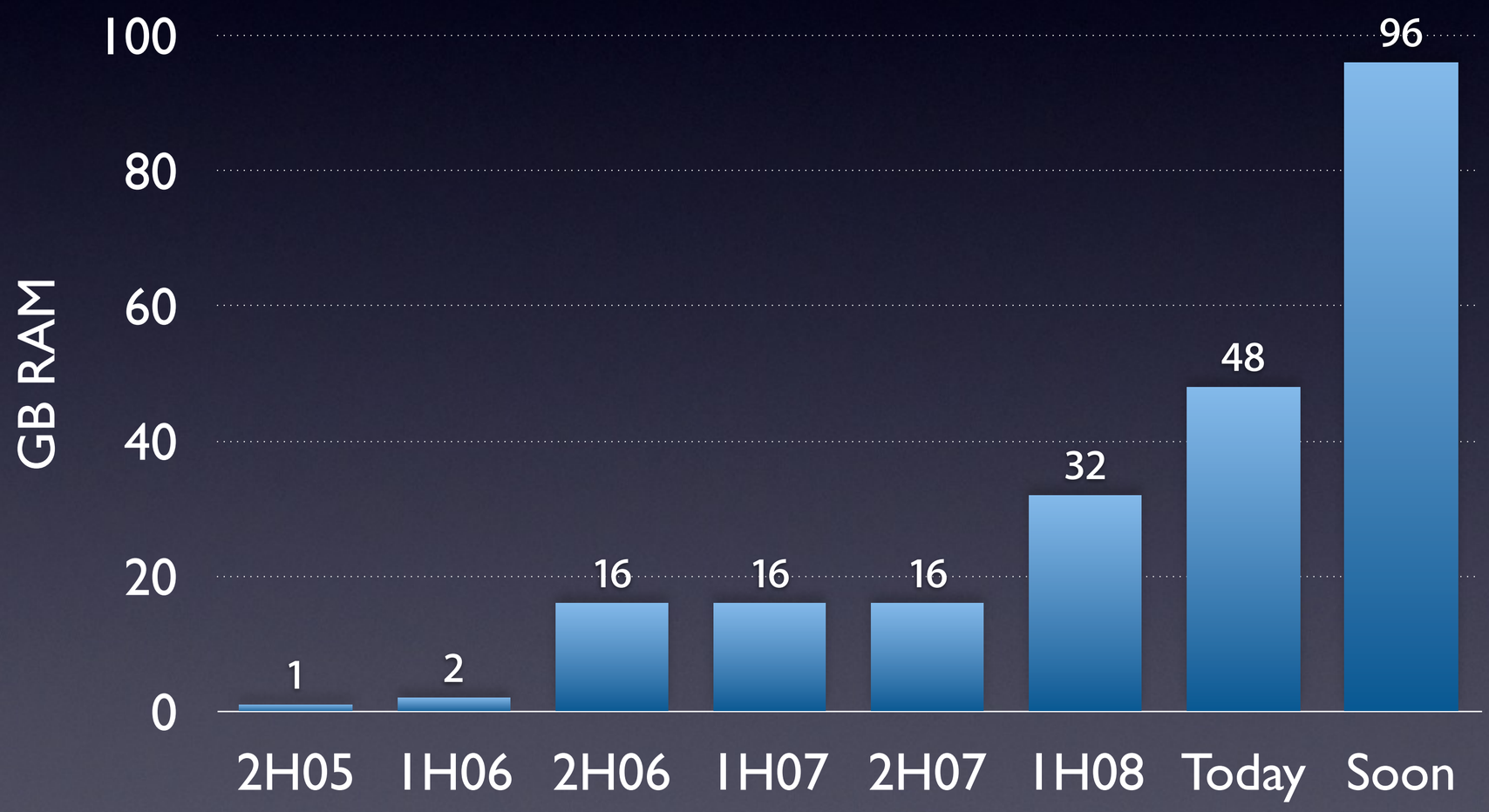
64-bit Cocoa apps

32 and 64 bit applications

K64

Why K64?

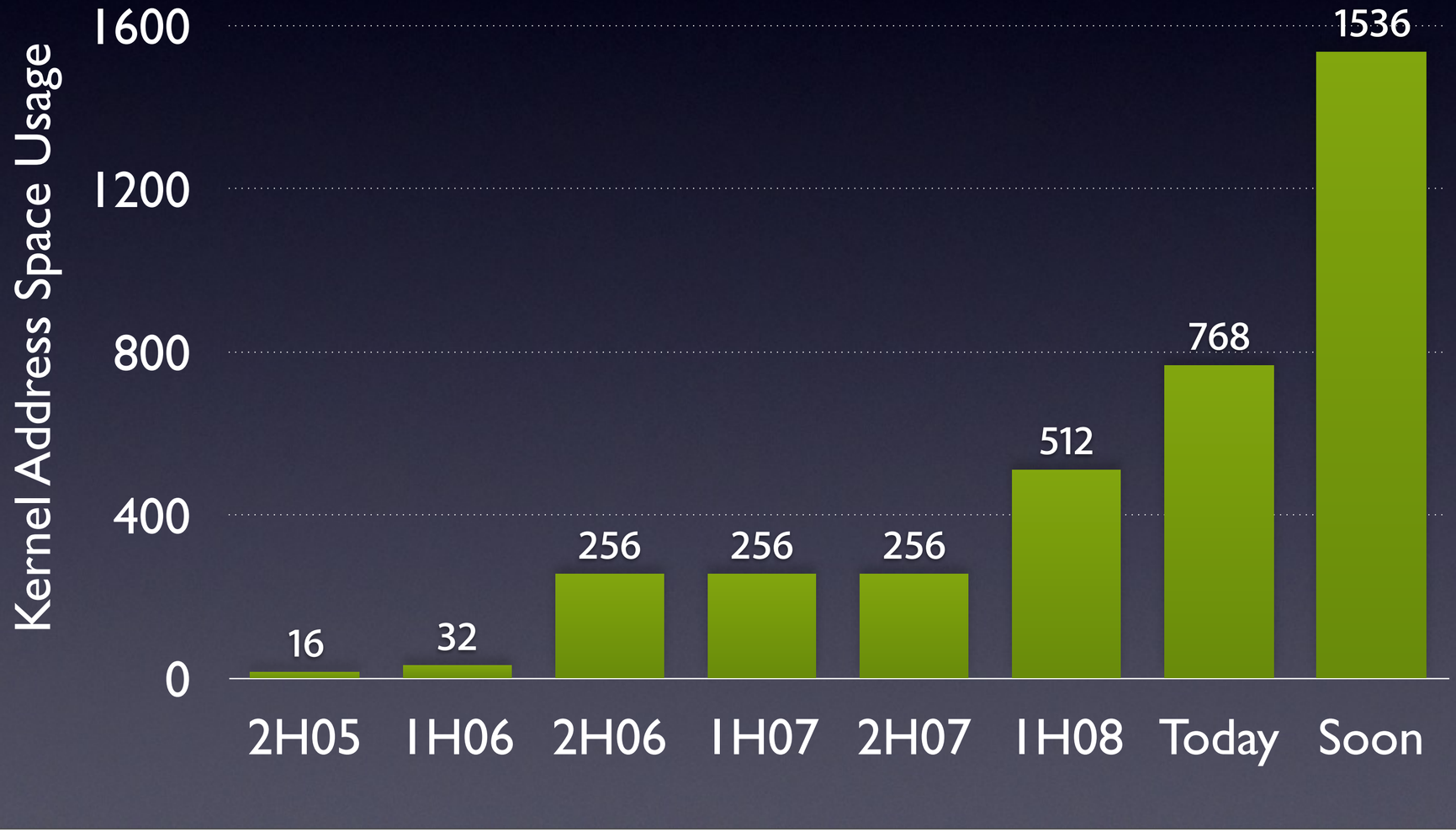
Physical RAM sizes rapidly increasing



Why K64?

64B to describe each 4K page of RAM

1.5GB virtual space for 96GB RAM



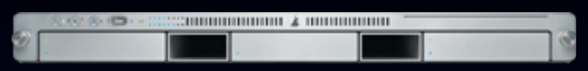
and Apps

100% binary compatible with K32

250% faster system call entry

70% faster user/kernel memory copy

and KEXTs



All KEXTs need to be 64-bit

Few KPIs removed

Remaining KPIs unchanged

Many KEXTs just recompile

K64

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File
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Call To Action

Mac OS X
Snow Leopard

3.0